TELEPHONY-BASED SPEECH RECOGNITION FOR PROVIDING INFORMATION FOR SORTING MAIL AND PACKAGES

TECHNICAL FIELD

The present invention relates generally to mail and package sortation systems, and relates more specifically to a telephony-based speech recognition system for providing information for sorting mail such as packages.

BACKGROUND OF THE INVENTION

Generally described, mail or package sortation can be a labor-intensive task. The sortation of mail or packages involves the use of a delivery address affixed to the mail or package. Operations including transportation, weighing, and sorting depend upon the reading of the delivery address. Once the delivery address is read, operations such as automated sorting and the creation of shipment records and billing documents rely upon the delivery address for the accuracy of the records and documents.

Conventional speech recognition systems have been employed by mail or package delivery companies to increase the efficiency of mail and package sortation. Generally, a user's speech input provides delivery address information to a remote computer. The remote computer processes the user's voice or speech input to compare the delivery address to a stored database of correct address information. The remote computer returns feedback to the user regarding the user's speech input. A computer can provide audio or visual feedback to the user regarding a delivery address. Audio feedback can take the form of an audio signal played back to the user via an earphone, headphone, or speaker. Visual

feedback can take the form of a video signal sent to a display screen or monitor for viewing by the user. Conventional sortation systems provide a signal to the user in the form of either an audio signal or a video signal for a display screen. The user receives the feedback from the computer, and the user acts accordingly in response to the signal.

One attempt at a speech recognition sortation system discloses a portable transaction terminal with a bar code reader, a microprocessor, a transceiver, a modem, a visual display, and a speech recognition system incorporated into a headset. When a user performs a sorting operation, the microprocessor receives information input from the bar code scanner or from the output of the speech recognition system processing alphanumeric names and words spoken by the user into the headset. Via the modem, the tranceiver can exchange information with a remotely located modem. The microprocessor provides the user with preset audio messages through the headset or with information on the visual display. One drawback to the described equipment is that a headset incorporating features such as a bar code reader, a transceiver, a modem, a display, and a speech recognition system into a single headset makes the headset a complicated and expensive piece of equipment that could be uncomfortable for the user to wear and to operate. Furthermore, a headset containing such complex equipment could be expensive to manufacture and to maintain. Another drawback to the equipment is that the microprocessor cannot send a simultaneous signal, that is, an audio signal to the headset and a signal for the visual display, to the user for feedback.

Another attempt in the art to use speech recognition in mail or package sortation operations includes a headset and a self-contained portable computing apparatus. The computing apparatus includes a speech recognition module, and the headset includes a display for the user, and a microphone and speaker. When the user inputs voice data to the apparatus, the apparatus processes the information with an attached portable computer that provides data feedback to the user in the form of audio feedback through the headset or with visual information on the display. As with the portable transaction terminal described above, one drawback to the described portable computing apparatus is that a headset

incorporating features such as a speech recognition module, a display, a microphone, and a speaker into a headset makes the headset a complicated and expensive piece of equipment that could be uncomfortable for the user to wear and to operate in conjunction with a portable computer also worn by the user. Furthermore, a headset containing such complex apparatus could be expensive to manufacture and to maintain. Another drawback to the apparatus is that the portable computer cannot send a simultaneous signal, that is, an audio signal to the headset and a signal for the visual display, to the user for feedback.

Yet another attempt in the art uses a portable computer carried on the body of the user. The user communicates with the portable computer through a microphone installed in a headset. Spoken address information is sent by the user to the portable computer, where the information is processed into sorting information provided to the user. Again, a drawback is that the headset and portable computer could become uncomfortable for the user to wear and to operate. Furthermore, another drawback is that the portable computer cannot send simultaneous signals, that is, an audio signal to the headset and a signal for the visual display, to the user for feedback.

Therefore, there is a need in the art for a speech recognition system for sorting mail such as packages that is comfortable to wear, and easier to operate and to maintain than conventional systems and apparatuses. Furthermore, there is a need for a speech recognition system for sorting mail such as packages that can return simultaneous signals, that is, an audio signal to the headset and a signal for the visual display, to the user for feedback.

SUMMARY OF THE INVENTION

The present invention seeks to solve the problems described above. The present invention provides a telephony-based speech recognition system for providing information for sorting mail and packages that is comfortable to wear, easier to operate and to maintain than conventional systems and apparatuses. Furthermore, the present invention provides a telephony-based speech recognition system for providing information for sorting mail and packages that

can return simultaneous signals to the user for feedback. That is, the system provides simultaneous signals such as a voice signal to a user's headset and a data signal for a display screen or monitor for visual display of information. These objects are accomplished according to the present invention in a telephony-based speech recognition system for providing information for sorting mail and packages.

A telephony-based speech recognition system that provides the advantages above translates into a lower cost delivery address data acquisition and return system. Simultaneous signals sent in response to a user's spoken delivery address input can provide the user with multiple forms of feedback, and can provide one or more users the same or similar feedback for performing one or more different sortation or delivery operations. In addition, advantages such as user comfort in wearing equipment, ease of equipment operation, and lower maintenance costs, together reduce the overall costs involved in operating a speech recognition system for sorting mail and packages.

Generally described, the system includes a wireless telephony set for sending sortation information spoken by a user. A first modem receives the spoken sortation information from the wireless telephony set, and sends the spoken sortation information to a second modem through a telephony system. The second modem receives the spoken sortation information through the telephony system, and sends the spoken sortation information to a computer. The computer receives the signal containing the spoken sortation information from the second modem. The computer processes the signal using a speech recognition program, and in response to the spoken sortation information, the computer generates a return signal with a voice signal and a data signal. The computer sends the voice signal and the data signal to the second modem. The second modem encodes the data signal with the voice signal and sends the encoded return signal to the first modem through the telephony system. The first modem decodes the encoded return signal into the data signal and the voice signal. The first modem sends the voice signal to the wireless telephony set, and sends the data

signal to associated equipment such as a local computer for other feedback uses such as a visual display on a screen display or printing a label on a printer.

More particularly described, the wireless telephony set includes a microphone and a transmitter. When a user reads sortation information, such as a delivery address associated with a package, into the microphone, the transmitter sends a signal at a radio frequency to a base phone receiver. The base phone receiver sends the voice signal to a first simultaneous voice and data (SVD) modem. The first SVD modem transmits the voice signal through a public switched telephone network (PSTN) to a second SVD modem.

A second SVD modem receives the voice signal, and sends the signal through a telephony interface to a computer. The computer executes a stored set of instructions such as a speech recognition program to determine the spoken sortation information from the voice signal. In response to the sortation information, the computer generates a return signal with a voice signal and a data signal that is sent back to the second SVD modem. The SVD modem encodes the data signal with the voice signal so that a combination of signals may be sent by the second SVD modem through the public switched telephone network (PSTN) to the first SVD modem. The first SVD modem receives the return signal and decodes the return signal into the voice signal and the data signal. The first SVD modem sends the voice signal to the base phone receiver, and the base phone receiver sends the voice signal to the wireless telephony set. The receiver of the wireless telephony set transmits the voice signal to the speaker for output to the user.

The first SVD modem sends the data signal to a local computer, a printer, a display screen, or any combination of peripheral devices. The data signal can be used to format a label or a screen display. In one preferred embodiment, the data signal can be sent directly to a printer to print a label. Alternatively, the data signal can be sent directly to a display screen for viewing by a user.

In another aspect of the invention, the invention works in conjunction with a local area network (LAN) of computers. A user speaks sortation information into a microphone of a wireless set. The microphone transmits the spoken

sortation information to a transmitter. The transmitter sends a signal containing the spoken sortation information over a radio frequency to a speech device such as a speech encoder/decoder. The speech encoder/decoder sends a voice signal through a LAN to a computer. The computer receives the voice signal containing the spoken sortation information. A stored set of instructions such as a speech recognition program interprets the voice signal into the spoken sortation information. In response to the spoken sortation information, the computer generates a return signal with a voice signal and a data signal. The computer encodes the data signal with the voice signal, and sends the encoded signals through the LAN to the speech encoder/decoder. The speech encoder/decoder decodes or separates the return signal into the voice signal and the digital signal. The voice signal is sent to the receiver of the wireless set. The receiver transmits the voice signal to the speaker for output to the user. The voice signal can contain audio instructions or otherwise provide feedback for the user in response to the spoken sortation information.

The return signal can also be sent to a local computer through the LAN. The local computer decodes the return signal into the data signal. The data signal is sent to an associated printer, display screen or other peripheral device to format a label, display results, or otherwise provide feedback in response to the spoken sortation information.

Other objects, features, and advantages of the present invention will become apparent upon reading the following specification, when taken in conjunction with the drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of a first embodiment of the present invention.

FIG. 2 is a functional block diagram of a second embodiment of the present invention.

FIG. 3 is a flowchart illustrating a first method of the present invention.

DETAILED DESCRIPTION OF INVENTION EMBODIMENTS

The invention may be embodied in a system for providing information for sorting mail and packages. In response to receiving a user's voice input containing sortation instructions through a public switched telephony network, a computer such as a central or remote computer uses a speech recognition program to interpret the user's voice input. A response routine associated with the central or remote computer creates a return signal, such as a data signal and a voice signal. The central or remote computer sends the return signal to an encoder device such as a SVD modem to encode the data signal with the voice signal for simultaneous signal transmission through the public switched telephony network. A decoder device such as another SVD modem receives the return signal through the public switched telephony network and separates or decodes the return signal into the data signal and the voice signal. Each signal portion of the return signal is sent to the user or to several users for various devices and applications, such as an audio headset for an audio response, a display screen or monitor for visual information display, a printer for a label or similar tangible feedback, or similar types of peripheral devices for other mail or sortation functions.

The present invention can be embodied in a system with a computer such as a central or remote computer connected to a first SVD modem in communication with a second SVD modem through a public switched telephony network. A user communicates with the system through a wireless telephony set in communication with a base phone receiver. The wireless telephony set sends a radio communication transmission to the base phone receiver. The base phone receiver sends the user's voice input to the first SVD modem. The first SVD modem converts the user's voice input into a voice signal for transmission through the public switched telephony network to the second SVD modem. The second SVD modem receives the voice signal containing the user's voice input, and sends the voice signal to the central or remote computer. In some cases a telephony interface receives the digital signal prior to the signal reaching the central or remote computer. A speech recognition program associated with the central or remote computer interprets the user's voice input, and a response

routine stored in the computer compares the user's voice input to a database of sortation information. The response routine generates a return signal containing, for example, a voice signal and a data signal in response to the user's voice input.

The response routine sends the return signal to the second SVD modem to encode the data signal with the voice signal for simultaneous transmission to the first SVD modem through the public switched telephony network. When the first SVD modem receives the return signal, the modem decodes the return signal into the voice signal and the data signal. The first SVD modem sends the voice signal to the base telephone receiver for further transmission to the user through the wireless telephony set. Furthermore, the first SVD modem sends the data signal to a local computer for processing of the signal for use with a display screen or monitor, a printer for formatting and printing a label, or another peripheral device.

The wireless telephony set can be any device that permits the user to communicate a voice input for transmission through a public switched telephony network, or similar type of network. A base telephone receiver can be any device that can exchange signals between a wireless telephony set and a modem.

The SVD modems used with the invention can be any type of modem or device that can send and receive simultaneous signals such as a data signal and a voice signal. Furthermore, the SVD modems can be any device that can encode a data signal with a voice signal, and further decode the data signal from the voice signal. The public switched telephony network can be any type of network for exchanging signals such as analog and digital signals between two SVD modems.

The telephony interface can be any type of interface for sending and receiving signals from a computer. The computer can be a central or remote computer, or any type of computer or device that can execute a stored set of instructions for recognizing a user's voice input, for generating a response to the user's voice input, and for generating a return signal such as a data signal and a voice signal to be sent back to the user. Typically, a central or remote computer is located away from the user's location, and is accessible by the user through a telephony system or a computer network connection. In some cases, the central or remote computer can be located near or at the user's location, but access is still

made by the user through a telephony system or a computer network connection. The local computer can be any type of computer or device that can receive a data signal and process the signal for input to a peripheral device such as a printer, or a display screen or monitor. Typically, a local computer is located at or near the user's location, and can be readily accessible by the user if the data signal is processed for feedback such as a label, a visual display, or similar type of feedback. However, there are some cases when the local computer is positioned at a location inaccessible to the user, but the data signal is sent to another user for feedback such as printing a label, displaying a visual output, or for another similar type of feedback.

Referring now to the drawings, in which like numerals indicate like elements throughout the several views, FIG. 1 illustrates a first embodiment of the present invention. The system **100** includes a wireless telephony set **102**, a base phone receiver **104**, a first modem **106**, a public switched telephony network (PSTN) **108**, a second modem **110**, a telephony interface **112**, a central or remote computer **114**, and a local computer **116**.

The wireless telephony set **102** can be a conventional telephony headset configured to exchange signals between a user **118** and a base phone receiver **104** over a selected radio frequency. The wireless telephony set **102** includes a wireless receiver **120** connected to a speaker **122**, and a wireless transmitter **124** connected to a microphone **126**. The user **118** wears the wireless telephony set **102** upon the user's head or any other part of the user's body where the user **118** can speak into the microphone **126** and listen for an output signal through the speaker **122**. The wireless transmitter **124** is configured to send a radio signal **128** over a radio frequency from the wireless headset **102** to the base phone receiver **104**. The wireless receiver **120** is configured to receive a radio signal **128** over a radio frequency from a base phone receiver **104**, and further configured to transmit the signal **128** to the speaker **122**. A suitable wireless telephony set is a VL2h Voice Link system manufactured by Voice Communication Interface, Inc. of Wilton, Connecticut.

The base phone receiver **104** is configured for communicating a telephony signal **130a** between the wireless telephony set **102** and the first modem **106**. Typically, the base phone receiver **104** connects to the first modem **106** by a conventional telephony line. However, telephony connections may include the Internet, wireless communications, and other suitable links. A base phone receiver **104** can for example, be configured to communicate a telephony signal **130a** with the first modem **106** over a radio frequency.

The first modem **106** connects between the base phone receiver **104** and the PSTN **108**, and between the PSTN **108** and a local computer **116**. The first modem **106** is configured for sending and receiving a telephony signal **130a** from the base phone receiver **104**, as well as for transmitting the telephony signal **130a** to the PSTN **108**. The first modem **106** is further configured for receiving a data signal **132**, a voice signal **133**, or a combination of the two such as a composite return signal **134** from the PSTN **108**. Using conventional decoding methods and equipment, the first modem **106** is configured to decode or separate a composite return signal **134** with a data signal **132** and a voice signal **133** into a separate data signal component **132** and a voice signal component **133**. The first modem **106** is further configured to send the data signal **132** to a local computer **116**, and send the voice signal **133** to the base phone receiver **104**.

For example, in response to a user's voice input containing sortation information such as a delivery address, a return signal can be created with a voice signal containing a sortation instruction such as a particular sorting bin number to sort a piece of mail or package into, and a data signal containing a sortation instruction such as the particular bin number to sort a piece of mail or package. The voice signal is sent to the base telephone receiver, and transmitted to the user's wireless telephony set for audio receipt of the particular sorting bin number by the user, while the data signal is sent to the local computer for transmission to an associated printer to format and to print a label containing the particular sorting bin number. Other types of signals can be created such as a confirmation tone, or a pre-recorded or computer generated voice response. Other data signals can be created such as text or numeric strings. Using a voice signal combined

with a data signal, a return signal can provide sortation information to the user to verify, correct, prompt, or otherwise provide feedback to the user's spoken sortation information.

A suitable first modem is a simultaneous voice and data (SVD) modem capable of communicating a voice signal to and from the base phone receiver **104**, and for decoding an encoded data signal received from the PSTN **108**. For example, a suitable first modem uses an RC288Aci/SVD chipset manufactured by Rockwell Telecommunications of Newport Beach, California.

The PSTN **108** connects between the first modem **106** and the second modem **110**. The PSTN **108** is a conventional public switched telephony system or other type of communication network configured for communicating a telephony signal, a data signal, or a combination of the two signals between the first modem **106** and the second modem **110**. The PSTN **108** communicates these types of signals between the first modem **106** and the second modem **110** by a conventional telephony line or through a radio frequency.

The second modem **110** connects between the PSTN **108** and a telephony interface **112** for a computer. The second modem **110** is configured for communicating a voice signal **130a** containing spoken sortation information from the PSTN **108** to a telephony interface **112**. Furthermore, the second modem **110** is configured for encoding and sending a return signal such as a data signal **132**, or a voice signal **133**, or a combination of the two signals such as a composite return signal **134**. The second modem **110** uses conventional methods and techniques to encode the data signal **132** with the voice signal **133** to form a composite return signal **134**. A suitable second modem can be a simultaneous voice and data (SVD) modem capable of multiplexing voice signal with other signals such as a data signal. For example, a suitable second modem uses a RC288Aci/SVD chipset manufactured by Rockwell Telecommunications of Newport Beach, California.

The telephony interface **112** connects between the second modem **110** and a computer such as a central or remote computer **114**. The telephony interface **112** is configured for receiving a voice signal **130a** from the second modem **110**,

and further configured for converting the received signal **130a** to a useful format for the central or remote computer **114**. A suitable telephony interface can be a conventional analog-to-digital converter for converting a voice signal **130a** to a digital signal **130b** for a computer.

As noted, the central or remote computer **114** connects to the telephony interface **112**. The central or remote computer **114** is configured to process a received digitized signal or telephony signal **130b** containing the spoken sortation information from the telephony interface **112**, and is further configured to generate a return signal such as a data signal **132**, a voice signal **133**, or a combination of the two, such as a data signal **132** encoded with a voice signal **133** in response to the spoken sortation information. Typically, the central or remote computer **114** stores a set of instructions containing a speech recognition program **136**, or the set of instructions with a speech recognition program **136** can be stored in an external device (not shown) or format accessible by the central or remote computer **114**. The computer **114** executes the speech recognition program **136** to process the received signal containing the spoken sortation information into a computer-readable format, such as a data string that can be processed by the computer **114**.

The computer **114** is configured to execute a stored set of instructions containing a response routine (not shown) to use the spoken sortation information processed from the speech recognition program **136** to generate a return signal. Typically, the computer **114** can access a database (not shown) or a storage device containing sortation information. For example, the computer **114** is configured to process the received spoken sortation information such as a delivery address by checking a database such as a database containing previously stored delivery addresses to verify the accuracy of the received sortation information. The response routine is configured to use the database sortation information to create a return signal such as a digitized signal containing a voice response with the particular sorting bin number and a data signal with the particular sorting bin number corresponding to the user's spoken delivery address. Other response routines can be configured to use spoken sortation information processed from the

speech recognition program **136** to generate a return signal based upon comparison to a database, information in a storage device, or data stored in other similar structures or devices.

Thus, in response to the received spoken sortation information, the central or remote computer **114** is configured to generate a return signal such as a data signal **132** or a voice signal **133,** or a combination of the two, as a composite return signal **134**. The computer **114** can send the return signal back to the user **118** or to a local computer **116** for associated uses in the following manner.

The central or remote computer **114** connects to the second modem **110**. As previously described, the second modem **110** is configured for multiplexing a voice signal with other signals such as a digital signal. That is, the second modem **110** is configured to transmit a return signal containing a combination of voice and data signals from the computer **114** to the PSTN **108**. Furthermore, the PSTN **108** connects to the first modem **106**, and is configured to transmit simultaneous voice and data signals from the second modem **110** to the first modem **106**.

The local computer **116** connects between the first modem **106** and computer peripheral devices such as a printer **138** and display screen **140**. The local computer **116** is configured for processing the decoded data signal component from the central or remote computer **114**. The processed data signal component can be formatted with an associated printer **138** connected to the local computer **116**. In addition, the processed data signal component can be formatted and printed for visual display on an associated display screen **140** connected to the local computer **116**. Other associated computer peripheral devices such as a storage device or other output devices can be configured to receive the processed data signal component from the local computer **116**. Alternatively, the first modem **106** can connect directly to a computer peripheral device, such as the printer **138** or the display screen **140**, where the first modem **106** is configured to bypass the local computer **116** to send the decoded data return signal directly to the computer peripheral device **138, 140**.

To operate a telephony-based speech recognition system **100**, a user **118** wears a wireless telephony set **102**. The user **118** initiates a sortation operation such as sorting a package **142**, or a letter, a parcel, and the like. The user **118** reads sortation information, such as a package delivery address **144** on a label **146** associated with the package **142**, into a microphone **126** of the wireless telephony set **102**. The microphone **126** transfers the spoken sortation information to a wireless transmitter **124** of the wireless telephony set **102**. The wireless transmitter **124** sends a radio signal **128** containing the spoken sortation information over a radio frequency to a base phone receiver **104**.

The base phone receiver **104** receives the radio signal **128** from the transmitter **124**, and generates a voice telephony signal **130a** containing the spoken sortation information. The base phone receiver **104** sends the voice telephony signal **130a** to a first modem **106** by way of a radio frequency or conventional telephony line.

The first modem **106** receives the voice telephony signal **130a** containing the sortation information from the base phone receiver **104**. The first modem **106** sends the voice telephony signal **130a** containing the spoken sortation information through the public switched telephony network (PSTN) **108**. The PSTN **108** receives the voice signal **130a** containing the spoken sortation information from the first modem **106**, and transmits the signal **130a** to a second modem **110** by way of a radio frequency or conventional telephony line.

When the second modem **110** receives the voice signal **130a** from the PSTN **108**, the second modem **110** sends the voice signal **130a** to a telephony interface **112**. The telephony interface **112** receives the signal **130a** from the telephony interface **112**, and converts the signal **130a** to a format **130b** to allow the central or remote computer **114** to execute a speech recognition program **136**.

When the central or remote computer **114** receives the converted signal **130b** from the telephony interface **112**, the computer **114** executes a set of instructions containing a speech recognition program **136** to interpret the spoken sortation information in the converted signal **130b**. The speech recognition program **136** processes the spoken sortation information to determine the content

of the spoken sortation information. For example, the spoken sortation information can contain a delivery address **144** on a label **146** affixed to a package **142**. The speech recognition program **136** interprets the converted signal **130b** as the user-spoken delivery address for use by an associated response routine (not shown).

The response routine uses the results from the speech recognition program **136** to generate a return signal such as a digitized voice signal **133** or a data signal **132**, or both as a composite return signal **134**, in response to the spoken sortation information. A return signal is a response sent back to the user **118**, to the local computer **116**, or to a computer peripheral device **138, 140** based upon the spoken sortation information, such as a delivery address **144**. For example, the computer **114** can access an internal or external database to verify or compare the spoken sortation information containing a delivery address **144** with previously stored addresses. In response to finding a matching address to the delivery address, the computer **114** generates a corresponding return signal such as a validated text string. The validated text string can contain a verification code authorizing the delivery of the package to the delivery address **144**, or to a particular sorting bin corresponding to the delivery address **144**. Alternatively, in response to finding no matching delivery address, the computer **114** generates a corresponding return signal such as a validated text string containing a code rejecting the delivery of the package to the delivery address **144**. In either case, the validated text string in the return signal is sent to the user **118** to verify, correct, prompt, or otherwise provide feedback for the user's spoken sortation information.

Other examples of a return signal that can be generated by the computer such as a central or remote computer **114** are a voice signal that contains a prompt for a user, a query for additional sortation information, or other similar types of feedback for the user **118**. Yet another example of a return signal that can be generated by the central or remote computer **114** is a composite return signal **134** such as a data signal **132** encoded with a voice **133**. The data signal **132** can contain return sortation information, such as a sorting bin identification code, a

confirmation code, and the voice signal **133** can contain an audio confirmation response.

The central or remote computer **114** sends the voice signal **133** back to the user **118** through the system **100**. The voice signal portion **133** is sent from the central or remote computer **114** through the telephony interface **112** to the second modem **110**. The second modem **110** receives the voice signal **133** from the telephony interface **112**.

The digital signal **132** is sent from the central or remote computer **114** directly to the second modem **110**. The second modem **110** receives both the data signal **132** and the voice signal **133**, and encodes the data signal **132** with the voice signal **133** to form a composite return signal **134**. The second modem **110** sends the composite return signal **134** containing the data signal **132** and the voice signal **133** through the PSTN **108** to the first modem **106**.

The first modem **106**, previously described as configured to handle simultaneous voice and data transmission, receives the composite return signal **134** containing voice signal **133** and the data signal **132**. The first modem **106** decodes the composite return signal **134** into the separate voice signal **133** and the data signal **132**. The decoded voice signal **133** is sent to the user **118** through the base wireless phone receiver **104**. The base wireless phone receiver **104** receives the voice signal **133** from the first modem **106**, and then sends the voice signal **133** to the wireless receiver **120** in the user's wireless telephony headset **102**. The user **118** receives the voice signal **133** in the form of an audio signal containing return sortation information, such as a sorting bin number or a confirmation tone, transmitted from the wireless receiver **120** to the speaker **122** in the user's wireless telephony headset **102**.

The decoded data signal portion **132** is sent by the first modem **106** to a local computer **116** connected to the first modem **106**. The local computer **116** receives the data signal **132**, and uses the data signal **132** as input into a stored set of instructions. The local computer **116** can execute the stored set of instructions to instruct an associated printer **138** to print a label with a MaxiCode symbol, a

bar code, a zip code, or other type of machine-readable code or text information, or to display information on an associated display monitor **140** or screen.

Alternatively, the first modem **106** can send the data signal **132** to a printer **138** associated with the first modem **106**. Using the data signal **132**, the printer **138** can format and print return sortation information contained within the data signal portion **132**. Furthermore, the data signal **132** can also be sent directly from the first modem **106** to a display monitor **140** or screen associated with the first modem **106**. Using the data signal **132**, the display monitor **140** or screen can visually display return sortation information contained within the data signal portion **132**.

FIG. 2 is a functional block diagram of a second embodiment of the present invention. The present invention is shown embodied in system **200** including a local area network (LAN) of computers **202**. The system **200** includes a speech device such as a speech encoder/decoder **204** in communication with the LAN **202** to exchange speech input signals and speech output signals with one or more associated computers **206, 208**. The speech encoder/decoder **204** is configured for digitally encoding a voice input signal from a user **210** for use by a computer. Furthermore, the speech encoder/decoder **204** is configured for decoding or converting a return signal from the LAN **202** to an audio format for the user **210**. The speech encoder/decoder **204** includes a processor **212** to convert a user's voice input into a digital signal format that can be communicated through the LAN **202** to one or more associated computers **206, 208**. For example, a speech encoder/decoder **204** can include a processor configured with Voice over the Internet Protocol (VoIP), or with a similar type protocol providing voice transmission over the Internet. Alternatively, the processor may be equipped with a speech recognition hardware or software module to convert a user's voice input to a format for transmission over the LAN **202** or Internet.

A wireless set **214** worn by the user **210** communicates with the speech encoder/decoder device **204** to exchange signals. The wireless set **214** can be similar to the wireless telephony set **102** described in FIG. 1, and can include similar type components such as a wireless receiver **216** connected to a speaker

218, and a wireless transmitter **220** connected to a microphone **222**. A user **210** wears the wireless set **214** upon the user's head or any other part of the user's body where the user **210** can speak into the microphone **222** and listen for an output signal through the speaker **218**.

The wireless transmitter **220** is configured to receive a user's voice input containing user spoken sortation information from the microphone **222**, and converts the user's voice input into a signal **224**. The wireless transmitter **220** is further configured to send the signal **224** over a radio frequency to the speech encoder/decoder **204**. The wireless receiver **216** is also configured to receive a signal **224** over a radio frequency from the speech encoder/decoder **204**, and further configured to transmit the signal **224** to the speaker **218**. A suitable wireless headset is a VL2h Voice Link system manufactured by Voice Communication Interface, Inc. of Wilton, Connecticut.

The LAN **202** is a distributed network of computers. The present invention can also be implemented with the Internet, an intranet, or other type of computer network. The LAN **202** connects between the speech encoder/decoder **204** and a computer such as a remote computer **206**. The LAN **202** is configured for transmitting a user's voice input that has been converted into a signal format using Voice over the Internet Protocol (VoIP) or a similar type protocol, or transmit a signal from speech recognition hardware or software as described above. Furthermore, the LAN **202** is configured for transmitting a data and encoded voice output return signal generated by the remote computer **206**.

The remote computer **206** is connected to the LAN **202** by a conventional data link so that the remote computer **206** is configured to communicate with the LAN **202**. The remote computer **206** is further configured for receiving a user's voice input that has been converted into a digital signal format using Voice over the Internet Protocol (VoIP) or a similar type protocol, or a signal from a speech recognition hardware or software module. Typically, a computer such as a remote computer **206** is at a location away from the location of the user **210** and further inaccessible to user, except by communication through the LAN **202**. In some cases, the local computer **208** is positioned at the location of or near the location

of the user **210**, however, the local computer **208** remains connected to the LAN **202** in communication with the local computer **208**. Using conventional speech recognition hardware or software (not shown), the remote computer **206** can process a signal format containing the user's voice input to determine a text string containing the user's spoken sortation information. In response to the user's spoken sortation information, the remote computer **206** uses a response routine (not shown) to generate a digital data return signal **227**, or an encoded audio output return signal **226**, or both **226, 227**. Typically, the remote computer **206** compares the spoken sortation information of the signal received from the LAN **202** to sortation information in an associated database. The remote computer **206** generates a digital data return signal **227**, or an encoded audio output return signal **226**, or both **226, 227**, based upon the comparison of the text string containing the spoken sortation information with the sortation information in the associated database. A suitable remote computer **206** is a Deskpro Pentium III desktop computer manufactured by Compaq Computer Corporation of Houston, Texas.

A local computer **208** connects to the LAN **202** with a conventional link so the local computer **208** can communicate with the LAN **202**. The local computer **208** is a computer connected to the LAN **202** in communication with the remote computer **206**. Typically, the local computer **208** is located at the location of or near the location of the user **210**. In some cases, the local computer **208** is positioned at a location inaccessible to the user **210**, however, the local computer **208** remains connected to the LAN **202** in communication with the remote computer **206**. The local computer **208** is configured to receive an output return signal that is a digital data return signal **227** from the remote computer **206** through the LAN **202**. The local computer **208** can process the digital data return signal **227**, and send a digital data return signal **227** to an associated printer **228** or a screen display **230** or monitor, or both. Other associated computer peripheral devices such as a storage device or other output devices can be configured to receive the digital data return signal from the local computer **208**.

The printer **228** receives the digital data return signal **227** from the local computer **208**. The printer **228** is configured for formatting and a printing information contained within the digital data return signal **227**.

The screen display **230** or monitor receives the digital data return signal **227** from the local computer **208**. The screen display **230** or monitor is configured for formatting and displaying information contained within the digital data return signal **227**.

Alternatively, the remote computer **206** can send the digital data return signal **227** directly to a printer **228** associated with the LAN **202**. Using the digital data return signal **227** the printer **228** can format and print return sortation information contained within the digital data return signal **227**. Furthermore, the digital data return signal **227** can also be sent directly from the remote computer **206** to a display monitor **230** or screen associated with the local computer **208**. Using the digital data return signal **227**, the display monitor **230** or screen can visually display sortation information contained within the digital data return signal **227**.

To operate the system **200**, a user **210** wears the wireless headset **214**. The user **210** initiates a sortation operation such as sorting a package **232**, or a letter, a parcel, and the like. The user **210** reads sortation information, such as a package delivery address **234** on a label **236** associated with the package **232**, into the microphone **222** of the wireless headset **214**. The microphone **222** transfers the spoken sortation information to the transmitter **220**, and the transmitter **220** sends a radio signal **224** to the speech encoder/decoder **204**. The speech encoder/decoder **204** receives the radio signal **224**, and the processor **212** converts the radio signal **224** into a digital signal for transmission over the LAN **202** using Voice over the Internet Protocol (VoIP) or a similar type protocol. Alternatively, the processor **212** may be equipped with conventional speech recognition hardware or software (not shown) that can convert the radio signal **224** containing spoken sortation information into a digital signal for transmission over the LAN **202** or Internet. The speech encoder/decoder **204** sends a signal **238** containing the spoken sortation information to the LAN **202**.

The LAN **202** receives the signal **238** from the speech encoder/decoder **204**, and transmits the signal **238** to the remote computer **206**. The remote computer **206** receives the signal **238** from the LAN **202**, and uses conventional speech recognition hardware or software (not shown) to process the signal **238** containing the spoken sortation information. In response to the spoken sortation information, the remote computer **206** generates an output return signal containing a digital data return signal **227**, an encoded audio output return signal **226**, or both **226, 227**. The remote computer **206** sends the output return signal containing an encoded audio return signal **226** back to the speech encoder/decoder **204** through the LAN **202**.

For example, the remote computer **206** can receive a signal **238** from the LAN **202** comprising spoken sortation information, such as a delivery address **234**. Using a speech recognition hardware or software module, the remote computer **206** processes the signal **238** into a text string format. The remote computer **206** compares the text string containing the spoken sortation information with an associated database (not shown) containing sortation information such as previously stored addresses. The remote computer **206** accesses the associated database to verify or compare the text string containing the spoken sortation information with previously stored addresses in the associated database. In response to finding a matching address to the spoken sortation information, the computer **206** generates a corresponding output return signal containing a digital data return signal **227** or an encoded audio output return signal **226**, or both **226, 227**, such as a validated text string. The validated text string can contain a verification code authorizing the delivery of the package to the delivery address. The remote computer **206** sends the output return signal containing the digital data return signal **227**, an encoded audio output return signal **226**, or both **226, 227**, back to the speech encoder/decoder device through the LAN **202**.

Alternatively, in response to finding no matching delivery address, the remote computer **206** generates a corresponding output return signal **226** such as a validated text string containing a code rejecting the delivery of the package to the

delivery address **234**. In either case, an output return signal **226** containing an encoded audio output return signal **226** is sent to the user **210** to verify, correct, prompt, or otherwise provide feedback for the user's spoken sortation information.

Other examples of an output return signal that can be generated by a computer such as a remote computer **206** are an audio signal that contains a prompt for a user, a query for additional sortation information, or other similar types of feedback for the user **210**. Another example of an output return signal that can be generated by the remote computer **206** is a digital data signal portion **227**. The digital data signal portion **227** can contain return sortation information, such as a confirmation code for a printer or a display.

The LAN **202** receives the output return signal **226** from the remote computer. The LAN **202** sends the output return signal **226** to the speech encoder/decoder **204**. The wireless receiver **216** of the speech encoder/decoder **204** receives the output return signal **226** from the LAN **202**. The encoder/decoder **204** sends the output return signal **226** to the processor **212**. The processor **212** decodes the output return signal **226** into an analog audio signal. The decoded audio signal is sent as a signal **224** through a radio frequency to the receiver **220** of the wireless set **218**. The receiver transfers the signal **224** to the speaker **218** of the wireless set **218**. The user **210** listens to the signal **224** in the form of an audio signal containing return sortation information transmitted from the speaker **218**.

The processor **212** can also send a decoded digital data signal **227** to the user **210**. The processor **212** can operate in conjunction with conventional speech synthesis software or hardware (not shown) to create synthesized speech. The synthesized speech can be sent to the user **210** through the speaker **218** in the user's wireless set **218**. For example, a digital data signal **227** containing return sortation information can be processed by the speech synthesis software or hardware module to create a synthesized speech command. The processor **212** sends the synthesized speech command through a signal **224** by radio frequency to the receiver **220**. The receiver **220** transfers the signal to the speaker **218**, so

that the speaker **218** can broadcast the synthesized speech command to the user **210**.

FIG. 3 is a logic flow diagram illustrating a first method of the present invention. The first method **300** can be used with different embodiments of the invention. For example, the first method **300** is described as follows in conjunction with the system **100** described in FIG. 1. The first method **300** begins at step **302**.

Step **302** is followed by step **304**, in which the system **100** receives spoken sortation information containing a package address from a user. As shown in FIG. 1, a user **118** wears a wireless telephony set **102**. The user **118** initiates a sortation operation such as sorting a package **142**, or a letter, a parcel, and the like. The user reads sortation information, such as a delivery address **144** on an associated label **146** on the package **142**, into a microphone **126** of a wireless telephony set **102**.

Step **304** is followed by step **306**, in which the system **100** sends the spoken sortation information to a remote computer **114**. The microphone **126** transfers the spoken sortation information to a transmitter **124** that sends a radio signal **128** containing the spoken sortation information to a base phone receiver **104**. The base phone receiver **104** sends a voice signal **130a** containing the spoken sortation information to a first modem **106** by way of a radio frequency or conventional telephony line. The first modem **106** sends the voice signal **130a** containing the spoken sortation information through a public switched telephony network (PSTN) **108**. The PSTN **108** transmits the signal **130a** to a second modem **110** by way of a radio frequency or conventional telephony line. The second modem **110** sends the voice signal **130a** to a telephony interface **112**. The telephony interface converts the signal **130a** to a format for a computer such as a remote computer **114** executing a speech recognition program **136**. The remote computer **114** receives the converted signal **130b** from the telephony interface **112**, and processes the converted signal **130b** into sortation information.

Step **306** is followed by step **308**, in which the system **100** generates a return signal, such as a data signal **132**, a voice signal **133**, or a combination of

the two in a composite return signal **134**, in response to receiving the spoken sortation information such as a delivery address **144**. The remote computer **114** executes a set of instructions containing a speech recognition program **136** to interpret the spoken sortation information containing the delivery address in the converted signal **130b**. The speech recognition program **136** processes the spoken sortation information to determine sorting and/or delivery information. For example, the spoken sortation information can contain a delivery address **144** from a package **142** or a label **146**. A response routine, (not shown) uses the delivery address **144** from the speech recognition program **136** to generate a return signal in response to the spoken sortation information. A return signal is a response sent back to the user **118**, to the local computer **116**, or to a computer peripheral device **138, 140** based upon the spoken sortation information. For example, the computer **114** can access an internal or external database to verify or compare the spoken sortation information containing a delivery address **144** with previously stored addresses. In response to finding a matching address to the delivery address **144**, the computer **114** generates a corresponding return signal such as a validated text string. The validated text string can contain a verification code authorizing delivery to the delivery address **144**. Alternatively, in response to finding no matching delivery address, the computer **114** generates a corresponding return signal such as a validated text string containing a code rejecting the delivery to the delivery address **144**. In either case, the validated text string in the return signal is sent to the user **118** to verify, correct, prompt, or otherwise provide feedback for the user's spoken sortation information.

Step **308** is followed by step **310**, in which the system **100** encodes the return signal as a data signal **132**, a voice signal **133**, or a combination of the two as a composite return signal **134**. The remote computer **114** sends the voice signal **133** through the telephony interface **112** to the second modem **110**. The second modem **110** receives the voice signal **133** from the telephony interface **112**. The data signal **132** is sent from the central or remote computer **114** directly to the second modem **110**. The second modem **110** receives both the data signal

132 and the voice signal **133**, and encodes the data signal **132** with the voice signal **133** to form a composite return signal **134**.

Step **310** is followed by step **312**, in which the system **100** sends the composite return signal **134** to the first modem **106**. The second modem **110** sends the composite return signal **134** containing the data signal **132** and the voice signal **133** through the PSTN **108** to the first modem **106**.

Step **312** is followed by step **314**, in which the system **100** decodes the composite return signal **134**. The first modem **106** decodes the return signal **134** into the separate voice signal **133** and the data signal **132**. The decoded voice signal **133** can be sent to the user **118** through the base wireless phone receiver **104**. The base wireless phone receiver **104** receives the voice signal **133** from the first modem **106**, and then sends the voice signal **133** to the wireless receiver **120** in the user's wireless telephony headset **102**. The user receives the voice signal **133** in the form of an audio signal containing return sortation information transmitted from the wireless receiver **120** to the speaker **122** in the user's wireless telephony headset **102**.

The decoded data signal **132** can be sent by the first modem **106** to a local computer **116** connected to the first modem **106**. The local computer **116** receives the data signal **132**, and uses the data signal **132** as input into a stored set of instructions. The local computer **116** can execute the stored set of instructions to instruct an associated printer **138** to print a label, or to display information on an associated display monitor **140** or screen.

Step **314** is followed by step **316**, in which the method **300** ends.

In view of the foregoing, it will be appreciated that the invention provides a telephone-based speech recognition system for providing information for use in sorting packages and letters. The present invention provides a telephone-based speech recognition system for providing information for use in sorting packages and letters that is comfortable to wear, and easier to operate and to maintain than conventional systems and apparatuses. Furthermore, the present invention provides a telephony-based speech recognition system for providing information for sorting mail and packages that can return simultaneous signals to the user for

feedback. It will be understood that the preferred embodiment has been disclosed by way of example, and that other modifications may occur to those skilled in the art without departing from the scope and spirit of the appended claims.